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Organic Farming: Emerging Practices, Effect on Environment and Nutrition

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ABSTRACT

The global population surge has escalated the demand for food production. While conventional farming meets consumer demands, it often compromises food quality and safety. This method of agriculture has significant adverse effects on health and the environment, relying heavily on chemical fertilizers, costly seeds, and machinery. Conventional farming contributes to environmental degradation, food-borne illnesses, and soil infertility. In response to these issues, organic agriculture has gained prominence worldwide. The rising demand for organic products is driven by their nutritional and environmental benefits. Numerous studies have explored the advantages and disadvantages of various farming methods, comparing organic and conventional practices. This paper reviews the emerging impacts of organic farming on the environment and climate change and examines the nutritional differences and consumer preferences for vegetables produced by these two farming methods.

INTRODUCTION

The world population crossed over 8 billion on 15 November 2022 as per the Worldometer calculations and it is anticipated to peak in the 2080s at about 10.4 billion people (Gerland et al. 2022). Feeding the population is the primary concern of society. The demand for agricultural goods is anticipated to increase by 25-70% by 2050, putting additional pressure on the environment, especially on natural resources like water, soil, etc. (Hunter et al. 2017). However, the emergence of the green revolution in 1960-1970 solved the food shortage by increasing food production gradually to fulfill consumers' demand, but it also included the use of various chemicals and fertilizers to achieve its objectives. This use of artificial chemicals and fertilizers increased steadily in conventional agriculture (Azam & Shaheen 2019), which resulted in environmental degradation such as soil infertility, air pollution, excessive use of water, and the most affected is the quality of food crops.

Therefore, it became necessary to improve environmental sustainability and food quality through new innovative agricultural methods. In response to these challenges, scientists and agricultural experts started innovating new farming methods that make almost no use of chemicals, leading to an ancient form of farming, i.e., organic farming. Organic farming is the holistic approach and among the most effective chemical-restricted agricultural methods being used to increase crop production and sustain environmental resources (Heinrichs et al. 2021). Organic farming forbids the use of fertilizers, chemicals, and genetically modified organisms (GMOs) to protect the environment, maintain soil fertility, and maintain biodiversity (Tscharntke et al. 2021). Organic farming methods have gained popularity over the years.

Despite the growing popularity of organic farming, a comprehensive understanding of its relative advantages and disadvantages compared to conventional methods remains elusive. Numerous research studies have attempted to compare the two farming methods, but there are still significant gaps. Thus, there arises a need for collective information that synthesizes and summarizes the findings from research conducted on the developments in organic farming and its comparison with conventional farming practices from the early 1920s to 2023. This paper aims to provide a comprehensive overview of conventional farming, the impact of the green revolution on farming practices in India, historical developments in organic farming, as well as an in-depth analysis of the differences and impacts of both farming practices on various aspects such as the environment, soil quality, climate change, nutritional values, and consumer perspectives. The information for this review paper was collected from different authentic databases including PubMed, Google Scholar, and reports from various organizations such as IFOAM, APEDA, USDA, etc. By

synthesizing findings from a wide range of sources, we seek to explain the potential of organic farming to address contemporary agricultural challenges while promoting environmental sustainability and nutritional quality.

CONVENTIONAL FARMING

Historically, the term 'conventional' has been used to describe the process of cultivating crops on land using fresh water for irrigation, in an open area and excessive use of fertilizers (AlShrouf 2017). This is the most common agricultural method used for growing crops. Conventional agriculture is the most prevalent farming method which is being used for crop production in industrialized nations, therefore, it is also known as industrial agriculture. This approach was designed to cultivate higher amount of food crops with a lower cost of food production, but it accomplishes this at a massive environmental cost, as a substantial quantity of energy and chemicals are needed in conventional agriculture to obtain the required amount of crop productivity (Breza-Boruta et al. 2022).

Whereas growing crops through this method benefits the economy and food security it hinders nutritional security. Environmental protection and biodiversity are typically not sustained in conventional farming as they focus only on increasing crop yield but not on sustaining environmental resources. Conventional farming methods affect the environment adversely in various ways including the excessive use of soil for cultivation, fresh water for irrigation, and high concentration of chemical fertilizers (Alshrouf 2017) and adverse effects on humans, including a decline in human health, particularly in the reproductive and neurological systems (Azam & Shaheen 2019). This farming practice produces minimal returns even while using huge amounts of resources. Many chemical formulations are being introduced in conventional farming, to improve crop production and satisfy food demand which is threatening human health and natural resources.

Green Revolution in India and its Impact

After independence, the most chronic issue India faced was food scarcity. After the subcontinent was divided into India and Pakistan in 1947, the food crisis worsened, posing numerous difficulties for India's agricultural industry. Despite a significant increase in grain output following independence, it wasn't enough to fulfill the demands of a growing population. This necessity resulted in a revolutionary movement of food production known as the 'green revolution' (Rena 2004). Since the middle of the 1960s, the green revolution has allowed many emerging nations to see significant rates of increase in their domestic food grain production. In India, for instance, the average amount of cereal produce increased by 47% during the years 1952/53-1964/65 and 1967/1968-1977/1978. At the same time, there was a noticeable shift in the coefficient of variation surrounding the trend of total cereal output which rose from 4.7% to 5.9% (Hazell 1984, Pinstrup-Andersen & Hazell 1985). Conventional agriculture is frequently seen to be a logical progression from the green revolution which was started by Norman Borlaug in India. Durham & Mizik (2021) described this method as massive, heavily automated, and reliant on the use of various chemicals and fertilizers. The revolutionary movement of crop production or the green revolution was highly effective which reduced the food shortage progressively and increased food production, but with time, the enormous agricultural operation began to shrivel, and the quality of soil and food started deteriorating due to the continuous use of synthetic fertilizers and strong chemicals (Harish 2020).

ORGANIC FARMING

The ancient and most promising agricultural method to address the emerging concerns of the environment including farming, food quality, and safety and welfare for animals is organic farming (Dhiman 2020). Organic agriculture is the holistic approach used in sustaining environmental resources and improving the quality of products grown. This is considered to be a safer cultivation method without the use of any chemicals or pesticides. Scientific studies conducted on organic foods have reported that organic farming surpasses conventional farming in several aspects, focusing on sustainable practices that promote soil health and biodiversity including nutritional benefits, crop yield, soil quality, pesticides, and so on.

The word "organic" is derived from a living substance which is also known as natural. Thus organic refers to a substance produced naturally or by using living organisms. The International Federation for Organic Agriculture Movement (IFOAM) defined "organic agriculture as a cultivation system that promotes the sustainability of environment, soil, and humans. It relies on biological processes, bio-diversity, and processes that are suitable to natural circumstances despite using elements that have harmful effects.

Organic agriculture integrates science, creativity, and tradition to protect the environment, foster equitable relationships, and advance a better quality of life for all involved. In other words, organic farming employs a range of natural approaches including the use of organic remedies, bio-fertilizers, bio pest management, and crop rotation methods while avoiding chemicals, pesticides, and fertilizers, to improve the food quality and advance sustainability (Kontopoulou et al. 2015). Compared to conventional

farming, organic farming reduces the total quantity of nitrate that enters both ground and surface water, employs compost as fertilizer, recycles animal waste, and reduces soil loss.

Origin and History

Indian organic farming has been more significant nowadays due to its high-quality output, environmental safety, and lucrative living. Though the concept of "organic agriculture" has gained prominence recently, the pieces of evidence can be found in history. The Vedas of the "Later Vedic Period," which spanned from 1000 BC to 600 BC, are believed to have developed the first "scientific" method of organic farming (Randhawa 1986). The secret is to align with nature rather than destroy it. The three main texts in this context are "Vrikshayurveda" (the study of longevity and the health of plants), "Krishisastra" (the study of agriculture), and "Mrugayurveda" (the study of animals) (Mahale & Soree 1999).

Vedic scriptures make mention of knowledge of agriculture, plant biodiversity, etc. Panchagavya, the earliest and original organic bio-fertilizer, was used in Vedic farming. The term "Panchagavya" in Sanskrit refers to a mixture of different five products derived by cow, viz., milk, ghee, yogurt, dung, and urine. When these components are combined with water, this results in a product known as "Amrit-pani," a nourishing nectar used to irrigate the plantings and produce an abundance of healthy crops (Dhama et al. 2005, Ram & Garg 2020).

Various religious literatures such as Ramayana, Mahabharata, Rig Veda, Holy Quran, etc., have mentioned organic agriculture. Organic farming has its origins in the ancient agricultural methods that have been used for millennia in many rural settlements and villages. The historical texts of organic farming mention that it was practiced in the 'Neolithic age' by ancient civilizations around 10000 years back. The celestial cow Kamadhenu and its impact on the fertility of the soil and human existence are mentioned in Mahabharata, Kautilya Arthashastra mentioned several types of manures such as animal dung, etc. Brihad-Sanhita mentioned the techniques of manuring and how to select manures for various crops. Organic manure is also mentioned in Rig Veda and Atharva Veda II (Lichtfouse 2011).

Organic farming has been done since earlier times in the form of traditional farming and is far better than modern farming methods in the current global scenario. The father of modern organic agriculture is considered to be the British botanist Sir Albert Howard who mentioned that the ancient Indian agricultural system is superior to the present conventional farming system (Pandey & Singh 2012). The significance of decaying and dead matter for soil fertility and sustaining life is also discussed in the old Indian scriptures. In various portions of these publications, the significance of bio-composts and reusing post-harvest leftovers have additionally been covered. The movement of organic farming has strong roots that are presently implanted in worldwide culture (Barton 2017). The benefits of organic farming for environmental protection, food and nutrition security, and the battle against climate change are well known. Convictions rooted in philosophy, religion, and ideology have also led to the commercial use of organic farming with a business perspective of caring for the environment and producing high-quality goods (Behera et al. 2012).

Major Developments in Organic Farming

Organic agricultural methods have become popular in the past few years. The major developments in organic farming are summarised in Table 1.

Global Scenario

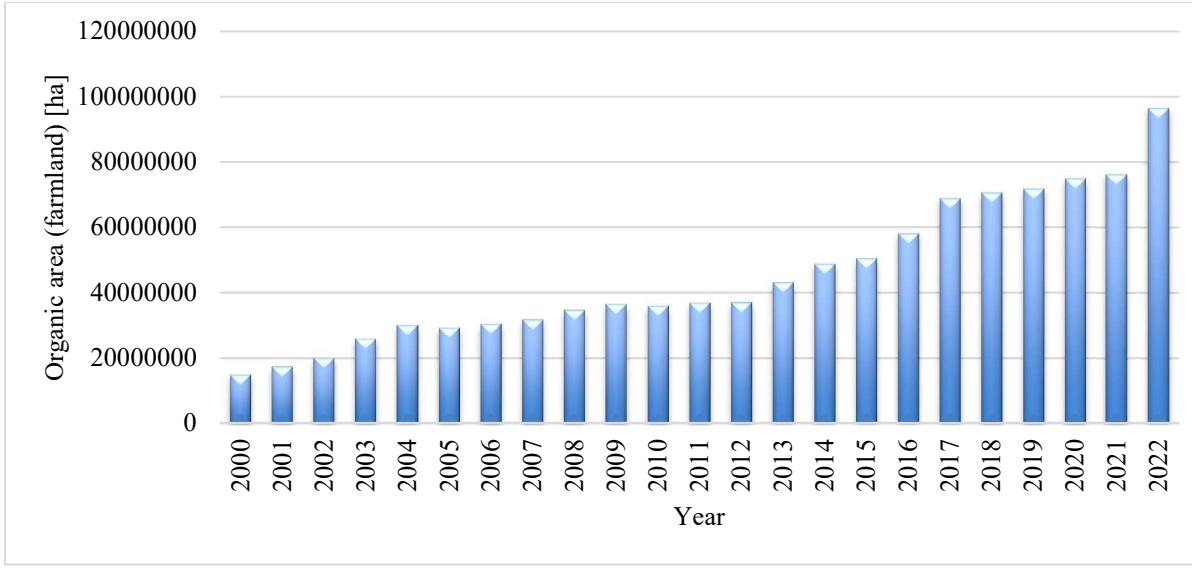
Organic farming has grown steadily in the global marketplace over the last few decades. From the 2000s, the market for organically grown products has rapidly increased. Fig. 1 represents annual statistics on the area of organic farmland from the year 2000 to 2022. Organic farmland increased from 11 million hectares to 43.7 million hectares from the year 1999 to 2014. The worldwide market of organic products was $15.2 billion in 1999 and expanded to $80 billion in 2014 and organic producers increased to 2.3 million in the year 2014 (IFOAM 2015). The organic market continued to grow worldwide and was more than $1000 billion in 2018 and there were about 2.8 million organic producers globally, the maximum being in India (IFOAM 2019). The annual data from the year 2000 to 2022 for Indian farmland for organic products along with its percentage of the total farmland is shown in Fig. 2. The latest FiBL survey report on global organic farming shows that organic farmland continued to grow and reached more than 74.9 million hectares by the year 2020. In organic farms, there has been a 4.1% (3.0 million hectare) rise seen in 2020 (IFOAM 2020). As of March 31, 2023, 10.17 million hectares (2022–2023) of land were registered under the National Programme for Organic Production (NPOP) that are subjected to the organic certification legal procedure. This comprises a cultivable area of 5391792.97 ha and a wild harvest gathering area of 4780130.56 ha of organic farming (APEDA 2023). Numerous nations reported a noticeable increase.

IMPACT OF THE ORGANIC FARMING ON ENVIRONMENT AND BIODIVERSITY

Organic farming has a substantial positive environmental

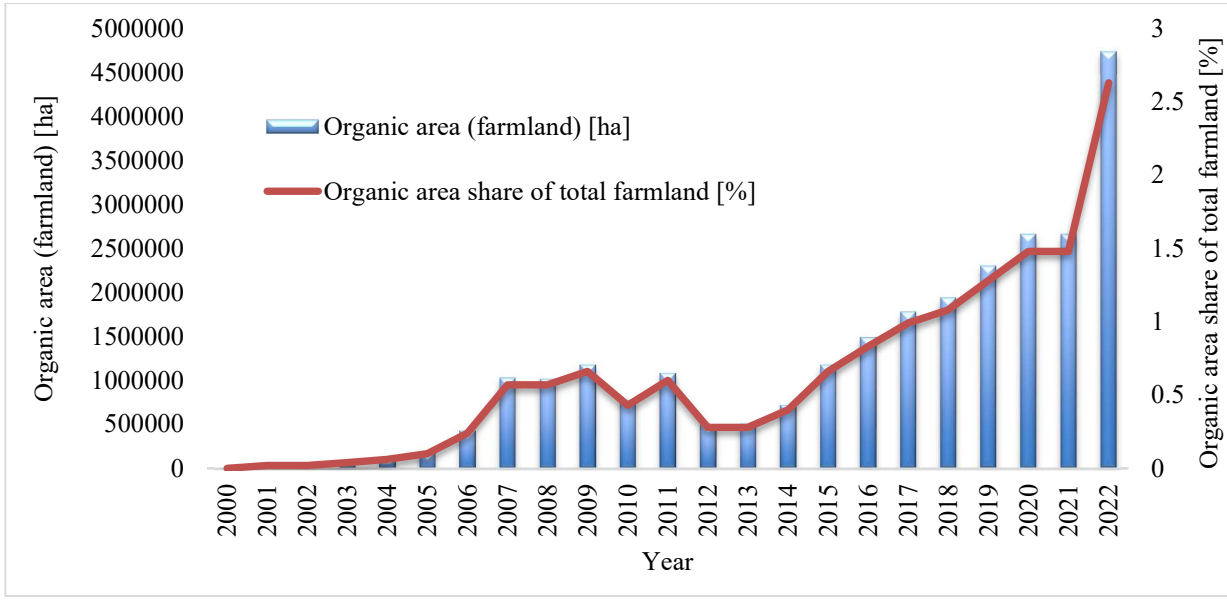
Table 1: Major developments in organic farming.

Major Developments	Year	Reference
Organic movement started by botanists Albert Howard and Gabrielle Howard	1921	Barton (2017)
Emergence of organic farming in Germany	1924	Paull (2011)
Rudolf Steiner's agricultural course on "Social scientific basis of agricultural development"	1924	Paull (2011)
Hans Mueler encouraged organic agriculture in Switzerland	1930	Tomaš-Simin & Glavaš Trbić (2016)
Mokichi Okada started Organic agricultural approach in Japan	1935	Okubo (1993)
Publication of "An Agricultural Testament" by Albert Howard	1940	Heckman (2006)
The book "Look to the Land" by Walter James aka Lord Northbourne and his focus on "farm as an organism"	1940	Paull (2006)
Organic Gardening magazine in the USA published by Rodale J.I. to avoid the use of chemicals in farming	1942	Klonsky & Tourte (1998)
Worldwide expansion of organic farming	1960s	Joachim (2006)
Rachel Carson's book "Silent Spring" underlined the effects of DDT and other pesticides on wildlife and the environment	1962	Santos (2017)
Principles of "Ecological Agriculture" propounded by William Albrecht	1970	Joachim (2006)
Establishment of IFOAM	1972	Geier (2007)
Foundation of Research Institute of Organic Agriculture (FiBL) in Switzerland was established	1973	Willer & Yussefi (2000)
Legislation of Organic Farming by the State of Oregon, USA	1974	Morgera et al. (2012)
Creation of the National Federation of Organic Farming in France	1978	Paull (2010)
Legislation on Organic Farming by State of California	1979	Morgera et al., (2012)
Basic standards and regulations by IFOAM for organic agriculture certifications	1980	Paull (2010)
"Report and Recommendations on Organic Farming" released by USDA	1980	USDA (1980)
Symposium on Organic Farming by American Society of Agronomy	1981	Elliott et al. (1984)
The US trade embargo in Cuba made it difficult to import chemical fertilizers which led them toward organic farming	1989	Warwick (1999)
BioFach Fair, the first fair on organic products organized by Germany	1990	Simin & Glavaš-Trbić (2016)
US Congress passed the Organic Foods Production Act (OFPA)	1990	Johnson (2008)
European Commission adopted EU regulations	1991	Morgera et al. (2012), Rundgren (2008)
EU member countries adopted EU regulations	1994	Morgera et al. (2012), Rundgren (2008)
First National Organic Program released by USDA	1997	Heckman (2006)
Introduction of Codex Alimentarius organic guidelines for animal husbandry	2001	Willer & Lernoud (2019)
Implementation of OFPA regulations	2002	Carter et al. (2015)
The first action plan on organic food and farming adopted by the European Commission	2004	Schmid et al. (2008)
Launch of National Organic Program by USDA	2006	NOP (2006)
IFOAM's new Organic Guarantee System was launched	2010	Willer & Lernoud (2019)
Marketing support to organic farmers by NABARD	2012	NABARD (2012)
Mission Organic Value Chain Development for Eastern Region (MOVCDNER)	2015	NCOF (2015)
Food Safety and Standards (Organic Food) Regulations were formed	2017	FSSAI (2017)
National Programme for Organic Production launched by APEDA in India	2018	APEDA (2018)
Launch of United Nations Decade of Family Farming 2019-2028	2019	FAO & IFAD (2019)
Implementation of organic regulations fully by 72 countries	2020	Willer et al. (2021)
Organic market reached more than 100 billion euros worldwide	2021	Willer et al. (2021)
IFOAM launched a new global map of Participatory Guarantee System Initiatives	2022	Willer et al. (2023)



(Source: FiBL Statistics)

Fig. 1: Annual global farmland for organic products.



(Source: FiBL Statistics)

Fig. 2: Annual Indian farmland for organic products with a percentage share of total farmland.

impact as it encourages sustainability and lessens the harmful consequences of conventional agricultural methods. It not only emphasizes using natural fertilizers, reducing the use of artificial chemical fertilizers, and improving soil health but also contributes to preserving ecological balance (Tripathi et al. 2023, Tong et al. 2022). Organic farming methods lower agricultural production costs while also improving soil quality as they focus more on the health of the soil instead of feeding the individual plant or crop. Thus, it lessens the chances of health hazards associated with residues which helps the environment and promotes ecological balance and sustainability. In comparison with conventional and low-input approaches, organic farming in greenhouses boosts soil fertility but poses higher ecological concerns due to the rise in heavy metals and antibiotic residues. Long-term organic farming, yet carries ecological dangers since it

may raise heavy metal levels and pesticide and antibiotic residues in the soil (Moreau et al. 2022). In comparison to traditional farming practices, organic farming promotes agro-environmental sustainability by recycling nutrients, using renewable resources, controlling pests organically, decreasing pollution, and safeguarding soils and ecosystems. Research indicates that organic agricultural practices enhance the diversity and quantity of beneficial creatures, such as predators, which improves pest control. By successfully controlling herbivore populations, organic agriculture supports the preservation of the biodiversity of natural enemies. Moreover, it increases soil microbial diversity, which supports more sustainable farming methods and better crop microbiomes. Since it increases species variety and ecosystem function, organic farming has a favorable influence on biodiversity.

Soil Quality

Agricultural practices are constantly using land areas in large quantities. These agricultural land usage results in severe hazards for soil degradation that exist globally and further agricultural intensification. The physical characteristics, microbe populations, nutrients present in the soil, and quality of soil are all influenced by agricultural treatments, and these changes could potentially have detrimental effects on human society (Setälä et al. 2014). Based on several factors, organic and conventional farming techniques have different soil quality. Improved soil physical characteristics, such as increased porosity and decreased bulk density, are typically observed in organic farming (Kim et al. 2023). Furthermore, compared to conventional systems, organic systems often have improved biological soil quality, with greater levels of soil organic carbon and more earthworm abundance (Krause et al. 2022, Maucieri et al. 2022). When it comes to the health of soil, long-term studies reported that organic farming can result in stable or increased levels of soil organic carbon (Aulakh et al. 2022, Maniraho et al. 2022). In organic agricultural methods, the use of natural waste and diversified cropping enhances the soil quality, whereas conventional farming relies more on agrochemical inputs, which may lead to imbalanced soil quality.

Climate Change

A contributing factor to global warming is the greenhouse gas (GHG) emissions from agriculture. In agriculture, carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) are the primary greenhouse gases (GHGs) (Devi et al. 2023). These gases are released through a variety of agricultural practices and have a substantial impact on climate change. The primary causes of N_2O emissions in agriculture are the use of chemical fertilizers, inadequate irrigation, and the deposition of animal excrement. N_2O emissions are mostly caused due to conventional farming using continuously synthetic fertilizers. Direct processes, such as nitrification and denitrification, as well as indirect ones, like nitrate leaching and runoff, both are responsible for these emissions. Whereas using organic fertilizers in agriculture has the potential to lower N_2O emissions as it uses only organic manure, and no artificial chemicals or fertilizers are used (Mousavi et al. 2023). Research indicates that substituting a segment of synthetic nitrogen fertilizers with organic manure can reduce greenhouse gas emissions and simultaneously enhance agricultural yields and soil fertility. Furthermore, owing to improved soil conditions, replacing synthetic fertilizers with organic manure over time may both reduce and increase N_2O emissions (Xie et al. 2022, Zhao et al. 2022). Thus, switching to organic farming and using less synthetic fertilizer may be essential to lowering N_2O emissions and advancing sustainable farming methods.

CO_2 emissions from organic farming are typically higher because compared to conventional farming, soil microbial activity is higher in organic agricultural systems (Santoni et al. 2022). Additionally, hydrothermal conditions have a greater impact on CO_2 emissions in conventional and organic farming. While there is enough enzymatic activity in both systems, invertase activity is higher in organic farming. Organic food production has a reduced carbon footprint per unit area and per unit of product, which helps to reduce overall greenhouse gas emissions (Chiriacò 2022). Conversely, conventional farming is associated with greater CO_2 emissions due to variables such as higher energy inputs, such as the transportation of imported feed and the manufacturing of energy-intensive concentrates. Despite these variances, soil microbial biomass, nutrient management strategies, and crop varieties planted in the system all affect the overall impact of organic agricultural practices on CO_2 emissions.

Many researches have indicated that organic agricultural practices can mitigate the release of greenhouse gases, such as CH_4. The application of organic fertilizers, such as native organic fertilizers, has been shown to reduce CH_4 emissions in paddy fields (Ravikumar et al. 2023). The organic fertilizers exhibit lower CH_4 emissions than chemical fertilizers. Furthermore, organic farming can to reduce total GHG emissions as evidenced by the comparison of conventional and organic arable farming systems, which showed that organic farming had zero CH_4 emissions and even functioned as a greenhouse gas sink in some situations (Biernat et al. 2020). When compared to conventional farming practices, these studies demonstrate the environmental benefits of organic farming in terms of reduced CH_4 emissions. The kind of fertilizer used had an impact on CH_4 emissions; industrial chemical synthesis

Table 2: Studies conducted on nutritional differences in conventional and organic vegetables.

Fruit/Vegetable	Parameters	Inferences	Reference
Fruits and vegetables	Vitamin C, Iron, Magnesium, Phosphorus, Nitrate	Organic foods have higher concentrations of vitamin C, iron, magnesium, and phosphorus and lower levels of nitrates in organic foods.	Worthington (2001)
Marionberries, Corn, Strawberry	Total Phenolic Content (TPC)	Levels of TPC were significantly higher in organically grown	Asami et al. (2003)
Leafy vegetables	Sugars, Vitamin C, Nitrate	Sugars and vitamin C were found consistently higher in organic vegetables with lower nitrate levels.	Xu et al. (2003)
Plums	Ascorbic acid, Alpha and Gamma Tocopherols and Beta-carotene	Greater levels of ascorbic acid, alpha, and gamma tocopherols, and beta-carotene in organic plums	Lombardi-Boccia et al. (2004)
Potatoes	Chlorogenic acid, Glycoalkaloids, Vitamin C	Higher chlorogenic acid content and vitamin C content with increased concentrations of glycoalkaloids in organically produced potatoes	Hajšlová et al. (2005)
Tomatoes	Titrable Acidity, Soluble Solids, Consistency	Higher amounts of titrable acidity, soluble solids, and consistency in organically grown tomatoes	Barrett et al. (2007)
Onions	Flavonoids, Vitamin C, Anthocyanins	Higher flavonoid, vitamin C, and anthocyanin content in organically produced onions	Hallman & Rembialkowska (2007)
Green vegetables	Heavy metals	Lower content of heavy metals in organic vegetables. Conventionally grown leafy greens, green pepper and spinach, and organically grown lettuce and green pepper exceeded the Cadmium limit recommended by FAO/WHO.	Dotse (2010)
Carrot, Celery, Red beet juices	Minerals and Heavy metals	Organic juices typically contain higher concentrations of minerals and heavy metal accumulation was higher in conventional juices.	Domagała-Świątkiewicz & Gąstoł (2012)
Red beetroot plants	Ascorbic acid, Antioxidant activity, Mineral components	Higher ascorbic acid, antioxidant activity, Sodium, copper, iron, manganese, nitrogen, and lower amounts of phosphorus, potassium, and magnesium in organic product	Straus et al. (2012)
Brassica vegetables	Glucosinolates and Antioxidant profile	Glucosinolates were twice as high in organically produced vegetables and antioxidant activity was higher in organic foods.	Vicas et al. (2013)
Lettuce, Pepper, Tomato	Dietary fiber	High total dietary fiber in organic vegetables	de Souza Araújo et al. (2014)
Onion	Flavonoids and Phenols	Similar flavonoid and phenol content in both	Lee et al. (2015)
Lettuce	Microelements	Compared to lettuce produced organically, commercial lettuce had higher levels of calcium, magnesium, manganese, iron, and copper.	Kapoulas et al. (2017)
Green leafy vegetables and other vegetables	Minerals, Vitamin C, Heavy metals	Mineral and vitamin C content is higher in organic samples. Organic vegetables were free from heavy metals.	Xavier et al. (2020)
Vegetables	Antioxidant compounds	Organic vegetables showed lower nitrate content, higher phenolics, antioxidant capacity, and soluble solids whereas only a few had higher ascorbic acid.	Roumeliotis et al. (2021)
Vegetables	Carotenoids	The only raw vegetable with a greater concentration of carotenoids in organic agriculture was carrot, although conventionally cultivated zucchini and broccoli had higher amounts.	de Castro et al. (2021)
Lemon	Amino acid, fatty acid, antioxidant activity, polyphenols	Conventionally grown lemons had higher amino acid and fatty acid content whereas no differences were found in antioxidant activity and polyphenol content among conventional and organic grown	Sánchez-Bravo et al. (2023)

fertilizers markedly increased CH_4 fluxes in comparison to organic resources such as organic manures (Sosa-Rodrigues & Garcia-Vivas 2019).

NUTRITIONAL COMPARISON

The nutritional content of fruits and vegetables is influenced by several factors, including factors from production to packaging such as genetic, ecological, and agricultural factors (Roumeliotis et al. 2021). Recently, agricultural systems have received a lot of attention among the aspects that have been studied. The majority of studies have compared various qualities of organic and conventionally grown vegetables, but recent reviews have found inconsistent differences in nutritional compounds. However, most research and review articles only focused on different parameters, and when it comes to the overall nutritional composition, insufficient information is available on the nutritional differences between conventional and organic vegetables and published findings are inconsistent. The collected review on nutritional differences between conventional and organic-grown fruits and vegetables is summarised in Table 2.

CONSUMER AWARENESS AND PURCHASING BEHAVIOR

During the COVID-19 epidemic, the Food Safety and Standards Authority of India's (FSSAI) 'Eat Right India' campaign enlightened the people about the value of eating the right foods and raised awareness about the need for wholesome food. This effort improved awareness amongst consumers about the advantages of choosing organic food. Consumers are concerned about safe food, nutrition, bio-active chemicals, and the dangers of pesticides (Rahman et al. 2021). The market for organic products is rising because more customers believe these items to be better for immunity, higher quality, and more readily available through online/e-commerce platforms (IFOAM 2019). Considerations for organic food products include freshness and sustainability of consumption, extrinsic qualities, health, nutritional benefits, sensory appeal, and socio-economic status. Additionally, depending on the product category, consumer motives, preferences, and attitudes can change. A positive attitude was found among consumers regarding organic vegetables and they also believe that organic agriculture promises environmental conservation, wildlife conservation, and the conservation of environmental resources (Melović et al. 2020). Organic vegetables have their own importance and surplus value which influences the purchasing behavior of consumers. Consumers choose organic products because of their nutritional value and fewer effects on the environment (Suciu et al. 2019).

A study conducted to assess the various factors that influence the purchasing behavior of consumers in India towards organic products revealed that consumer attitude towards organic food was affected by four factors: health consciousness, knowledge of organic foods, subjective norms, and perceived price. However, purchase intention was also affected by the four factors and another factor, i.e., availability. Results also showed that income was also one of the influencing factors as high-earners were more likely to purchase organic products. The findings also suggested that highly educated consumers are more inclined to purchase organic foods than consumers who are less educated (Singh & Verma 2017). A study conducted to observe the impact of the National Organic Program in the US in 2002 reported that consumers were prepared to pay higher rates for organically produced goods, including those that include less than 100% organic components. Consumers with children were more likely to spend more for cereals with organic content levels of 70–95% and 95–99% than were those without children. Compared to men, women were more likely to pay more for all features, especially those with larger percentages of organic, pesticide- and GM-free components (Batte et al. 2007). Modern consumer trends are heavily influenced by the increasing cases of lifestyle diseases including heart disease and depression. Rana & Paul (2017) also revealed in the review paper that consumers who are health conscious are continuously choosing organic products over conventionally produced food. Additionally, the purchase intentions of many consumers are based on their commitment to health, which is positively connected with their attitude and behavior toward purchasing. Organic products are considered safer and healthier, while organic methods are considered more ecologically friendly (Paul & Rana 2012). Therefore, more and more consumers are opting for organic produce from certified organic farms as a result of society's continually expanding ecological and nutritional consciousness. In addition to serving a nutritious purpose, such food may help people stay healthy and is crucial for preventing health problems in society (Breza-Boruta et al. 2022).

COMPARISON BETWEEN ORGANIC AND CONVENTIONAL FARMING

The majority of the population is dependent on conventional products. Various studies have compared conventional and organic agriculture based on various aspects such as nutritional parameters, soil health, crop yield, pesticide residues, and many more. As per Hans & Rao (2018), conventional agriculture is large-scale whereas organic farming is a small-scale production process. Conventional farming uses pesticides and fertilizers for crop production

that not only cause environmental damage but also contaminate food crops which can cause severe health problems in human beings while organic farming uses bio-fertilizers that do not cause any harm to the ecosystem and also release nutrients using micro-organisms (Al-Khafaji et al. 2018). In terms of biodiversity, organic farming is seen to be a better ecological substitute for conventional farming, which is connected to the loss of biodiversity worldwide and supports a higher diversity of fauna. GHG emissions from organic farming are lower than those from conventional agricultural methods. This paper discusses the differences between organic and conventional food products. The studies evaluated included information on environmental impact and benefits, soil quality, impact on climate change, nutritional quality, consumer perception and preferences, and the significant developments of organic farming. Most of the variations between conventional and organic products are substantially correlated with variations in GHG emissions, heavy metals, macro- and micronutrients, and consumer preferences. According to the literature reviewed, consumer preferences for organic products are found higher as compared to conventional produce. Despite some challenges, organic agricultural practices are acknowledged for their ability to minimize pollution, minimize environmental impact, maximize biological productivity, and support a healthy ecosystem.

CONCLUSIONS

Although conventional farming can feed the rising population, excessive pesticides, and fertilizers are harmful to human health and responsible for several diseases and illnesses. In this circumstance, organic farming has shown to be a more nutrient-dense, healthful, and sustainable agricultural method. The demand for organic food is always increasing. The desire for high-quality foods, the spread of ecologically friendly manufacturing techniques, and consumers' increased interest in leading healthy lifestyles are the main causes of organic product demands. India is the largest producer of organic goods globally. India is where organic farming first emerged, and it is predicted that organic farming practices will continue to be encouraged and implemented. India will soon become a country with a balanced diet, economy, environment, and health. Organic farming is practiced worldwide due to its advantages and eco-friendly attributes. Furthermore, there is a need for organic items on the global market, and the organic produce industry has lately had the quickest growth globally. There is still a requirement for further research about yielding more food products with fewer resources while preserving the environment and human health with more nutritional, ecological, and economic benefits.

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